Substitute Specification – Clean Copy

FIELD OF THE INVENTION

The present invention refers to an improved window lift assembly adapted for being fitted in the lock of a motor vehicle, conformation and design features fulfill the purpose that maximizes safety and effectiveness, and provides many advantages as it will be herein disclosed.

More particularly, the present invention refers to a window lifting device for motor vehicles that is fixed in the lock device of the motor vehicle, in which the track where the window pane driving slider is fixed to the lock device of the motor vehicle. In this particular type of window lift there is provided an additional slider within the frame of the door of the motor vehicle.

BACKGROUND OF THE INVENTION

The invention provides a window lifting devices in which the stability of the assembly, which is the main problem to be overcome in conventional window lifting devices, is guaranteed.

The above mentioned disadvantage of the conventional window lifting devices fixed to the lock of the motor vehicle lies are due to the fact that both fixing of the window in the slider and the guiding of the window result in backlash and interference which negatively influence the operation. Backlash and interferences are amplified to a large extent by the action of a cantilevered pane of the device because the window lifting device is mounted in the lock, particularly on a side end of the door.

Substitute Specification – Clean Copy

Practice has clearly shown that the main problem in ~~this~~ conventional window lifting devices resides in the difficulty of maintaining stability because the pane mentioned above in a high torque that makes the device unstable. Also, the load center of the device, that is to say, the weight of the pane plus frictions, is located quite far from the center of thrust of, the window lift driving cable.

SUMMARY OF THE INVENTION

With the aim of seeking an effective solution that maintains the static and dynamic stability needed for a window lifting device mounted in the lock of the door of a motor vehicle, the improved window lift assembly adapted for being fitted in the lock of a motor vehicle of the present invention has been developed, which will be herein fully described.

This window lift device is, as noted above, of the type of which essentially comprises two guide and slider assemblies, one of which is fitted in the frame of the door and the other of which is fitted in the track of the window lift device. It further comprises a slider driving mechanism that includes an electric motor having a gearmotor. The sliders are fixed to the window pane and the assembly is mounted attached to the lock of the motor vehicle with the track secured thereto.

The invention contemplates design variables for the stability of the device. The variables in this are set forth below:

(Y_1) : distance between two points of contact of the slider in the track measured on a line parallel to said track;

(Y_2): distance from the upper edge of the pane to the fastening point of the slider of the door;

(X_1): distance from an end of the track (which is secured to the door frame) to the points of contact of the slider in the track;

(X_2) : horizontal distance between two points of contact of the slider in the track;

(H): height of the lower edge of the door of the vehicle to the belt line; and

(h): height of the window of the vehicle.

The conditions which have to be met by said variables so that the design of this window lifting device is feasible are the following:

i) (Y_1) should be the maximum value possible for generating the maximum resistive torque to withstand the weight of the window pane and, at the same time, the condition that $(Y_1) < (H-h)$ should be also met in order to facilitate the assembly of the slider in the door;

ii) $(Y_2) < (h-Y_2)$ since the descent load is less than the ascent torque due to gravity. As the window pane moves upward, the window lift overcomes friction and the weight of the pane. As the pane moves downward, loads are equal to friction minus the

weight of the pane; and

iii) (Xi) should be as high or large as possible according to the geometry of the door.

In the event the value (Y_1) is very low or small, due to space reasons, and to the geometry of the door, it is preferable that (X2) ≤ (X1).

Preferably, (X1) is 100-150 mm, depending on the space available for assembly.

Therefore, according to the invention, the three variables (Y1, Y2, X1) allow the lift to be stable depending on the geometry and the loads on the door.

An increased or large(Y_1) involves a higher limitation of rotation of the window lift slider on the track, so that the window lift becomes stronger. On the other hand, (Y_2, X_2) depend on friction loads.

Regarding the design of the slider of the guide of the vehicle door, guiding inside the door frame may be carried out in three ways:

1- By providing a single point of contact inside ~~said~~ the guide, which allows rotation. In this case, in order to provide stability to the system, (Y_1) should be as high or large as possible, and (X_1) should be as low or small as possible and (Y_2) depends on the load.

2- Completely guided without possibility of rotation. In this case (Y_1) should be as low or small as possible to avoid

hyperstability and to prevent the system from being blocked, and (X_1) should be also as low or small as possible to avoid any possible blocking torques.

3- The slider will have a single point of contact as in the first case, but the pane completely rests on the door frame. In this case (Y_1, Y_2, X_1) should be calculated according to the geometry and loads of the door, without considering maximum and minimum values. (Y_1) should be an average value to avoid possible play in the assembly, while (Y_2, X_2) should be proportional to ascent and descent loads.

The sliders used in the window lift described according to the present invention are made preferably, but not exclusively, of carbon fiber and combinations thereof with POM, PP66 or other similar plastic materials suitable for this purpose with the addition of materials for promoting slippage and reducing the abrasive nature of the carbon fiber. With the choice of these materials it is possible to obtain sliders which are up to ten times more resistant than the conventional sliders made of POM and the like. Also, the carbon fiber allows reducing noise in use with regard to other materials typically employed for the same purpose.

A further important feature of the present invention is the mechanical link between the window lift driving mechanism and the lock device of the motor vehicle where it is mounted. Operation of locks in motor vehicles typically involves the use of several electric motors for driving a central locking system and other

related devices. The invention proposes the mechanical connection of the window lift driving mechanism with at least some of the devices associated with the lock assembly with the purpose of eliminating the need for at least one of the motors. In this sense, it should be especially stressed the fact that the feasibility of the mechanical transmission of, for example, the central locking system of a vehicle through the motor of the window lift fixed to the lock thereof is possible due to the high gear ration existing between the electric motor output shaft and a screw shaft meshed therewith which would act on the lock mechanism, which may be of the order of 1/70.

More particularly, if the following design variables are taken into consideration in calculation of the window lift driving mechanism:

α_1 = arch rotated by a drum of the motor which equals the distance of the driving cable and the pane move;

r = radius of the drum around which the driving 25 cable is wound;

β_1= angle rotated by the cable drum (in radians);

α_2= arch rotated by the electric motor before reduction;

β_2= angle rotated by the electric motor before the reduction (in radians);

Re = gear ration of the gearmotor between the drum axis and the electric motor output shaft;

it is provided that

$$\alpha_1 = \beta_1 \cdot r$$

and as $Re = \frac{\beta_2}{\beta_1}$, then:

$$\beta_1 = \frac{\beta_2}{Re}$$

Therefore, as

$$\alpha_1 = \beta_1 \cdot r$$

Then:

$$\alpha_1 = \frac{\beta_2 \cdot r}{Re}$$

Replacing the variables with typical values in a window lift as in the present invention:

$r = 5mm$

$Re = 70$

$$\alpha_1 = \frac{\beta_2 \cdot r}{Re} = \frac{\beta_2 \cdot 25}{70}$$

and expressed in degrees:

$$\alpha_1 = \frac{\beta_2 \cdot \mathbf{25} \cdot \boldsymbol{\pi}}{70 \cdot 180} = 0{,}0062333 \cdot \beta_2$$

$$\alpha_1 = \frac{\beta_2 \cdot}{} \Rightarrow \beta_2 = 160{,}427\ \alpha_1 \text{ (in mm)}$$

That is to say, if the travel length of the pane driving cable is 0,5 m, the electric motor rotates approximately 80°, so that there is an available energy for a mechanism like the lock device (and related mechanisms thereof) that requires a low amount of energy and this does not involve any discernable movements in the window lift. A displacement of 0,5 mm in the drum around which the window lift driving cable is wound is hardly appreciated since there are other factors as the compression of springs, cable, rubbers, etc. before the pane is moved.

The design proposed in the present invention provides many advantages:

- an accurate feasibility study of the window lift for determining stability in use according to the defined variables is thus made possible;

- the use of a window lifting device directly fitted to the lock of the door allows the free room inside the door to be

increased;

- the configuration of the window lift driving means according to the present invention allows at least one of the motors associated with the activation of the vehicle lock to be suppressed;

- a window lifting device designed according to the parameters of the present invention allows large sized and high weighted panes to be driven without problems.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by the following detailed description when considered in connection with the accompanying figure showing a side view of the improved window assembly in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of a window lift assembly according to the present invention is now described in detail and by way of a non limitative example, from which the features and the advantages of the invention will be clearly understood. The description that follows is given with reference to the drawing figure which corresponds to a diagrammatic elevational view of a vehicle door having a window lifting device according to the invention, a portion of the door being shown cut away so that the

assembly of guides and sliders as well as the window pane are clearly seen.

The embodiment that is herein described according to the enclosed drawing figure is an effective solution that provides static and dynamic stability required for a window lift device fitted in the lock of the motor vehicle door.

In the drawing figure, a door (1) of a vehicle is shown with the frame (2) where the pane (3) slides. The window lift device includes a first guide and slider assembly (4) in the frame (2) of the door (1) and a second guide and slider assembly (5) in the track (6) of the window lift.

The window lift is driven through an electric motor and a gearmotor (not shown).

A slider (7) is fixed to the lower edge (8) of the pane (3) at the fastening points (10), the assembly being fixed to the door lock with the track (6) secured thereto.

The slider (7) is made of carbon fiber and combinations thereof with POM, PP66 or other similar plastic materials suitable for this purpose with the addition of materials for promoting slippage and reducing the abrasive nature of the carbon fiber. Carbon fiber is preferred due to its low noise in use regarding other conventional materials.

The feasibility of this window lift assembly 20 depends on at least three variables (Y_1, Y_2, X_1) which are a function of the geometry and the loads on each door.

Variable (Y_1) corresponds to the distance between two points

of contact (P) of the slider (7) in the track (6) measured on a line parallel to said track (6) . Variable (Y_2) is the distance from the upper edge (11) of the pane (3) to the fastening point (12) of the first guide and slider assembly (4) running through the length (9) of the frame (2) of the door (1). The third design variable (X_1) is the distance from an end of the track (6) -which is secured to the frame (2) of the door (1)- to the points of contact (P) of the slider (7) in the track (6).

A fourth additional variable called (X_2) may be defined corresponding to the horizontal distance between two points of contact (P) of the slider (7) in the track (6).

Other values to be taken into consideration are the height (H) from the lower portion (14) of the door (1) of the vehicle to the belt line (13) ; and the height (h) of the window of the vehicle.

According to the invention, in order to make the design of the window lift feasible, one condition is that it is preferable that (Y_1) is the maximum value possible for generating the maximum resistive torque to withstand the weight of the pane (3). At the same time, it is preferred that (Y_1) is less than (H-h) to facilitate the assembly of the slider (7) in the door. (Y_2) should be less than the value (h-Y_2) since the descent load is less than the ascent torque due to gravity. As the pane (3) moves upward, the window lift overcomes friction as well as the weight of the pane (3), and as the pane (3) moves downward, loads are friction minus the weight of the pane(3) . Finally, the distance

(X_1) should be as great as maximized according to the geometry of the door (1).

If the distance (Y_1) is very small, due to limited space or the geometry of the door (1) , then the distance (X_2) should be less than or equal to (X_1), (X_2) being of the order of 100-150 mm, depending on the space available for assembly.

The longer distance (Y_1) allows a greater limitation of rotation of the slider (7) of the window lift on the track (6), so that the window lift becomes stronger. Distances(Y_2, X_2) depend on friction loads.

Regarding the design of the slider (4) guiding the slider (4) inside the frame (2) of the door (1) may be carried out by providing only a single point of contact between the slider and frame inside the guide so that rotation of the slider is allowed. In this case, to provide stability to the system, distance (Yi) should be as high or long as possible, (X1) should be as low or small as possible, and (Y2) being load dependant.

Alternatively, guiding the slider (4) inside the frame (2) of the door (1) may be carried out without any rotation, in which case, distance (Y_1) then should be as low or small as possible to avoid hyperstability and to prevent the lift system from being blocked, and distance (X_1) then being as low or small as possible to avoid any possible blocking torques.

Finally, guiding the slider (4) inside the frame (2) of the door 10 (1) may be also carried out according to the invention by providing a single point of contact as described above, but with

the pane (3) completely resting on the frame (2) of the door (1) . In this case (Y_1, Y_2, X_1) should be calculated according to the geometry and the loads, without considering maximum and minimum values. (Y_1) should be an average value to avoid possible malfunctions in the system, while (Y_2, X_2) should be proportional to ascent and descent loads.

Once having been sufficiently described what the 20 present invention consists according to the enclosed drawing, it is understood that any detail modification can be introduced as appropriate, provided that variations may alter the essence of the invention as summarised in the appended claims.